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**SANDIA NATIONAL LABORATORIES
CIVILIAN RADIOACTIVE WASTE MANAGEMENT
TECHNICAL PROCEDURE (TP)**

TP-261

**Measurement of Thermal Expansion of Geologic Specimens Using a
Simple Direct-Measurement Technique**

Revision 01

Effective Date: 03/04/03

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03/04/03
Date

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03/04/03
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03/04/03
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(Reviewer signatures above serve to document the review and resolution of comments.)

REVISION HISTORY

<u>Revision</u>	<u>Description</u>
0	Initial issue
1	Minor modifications to correct some typographical errors and to make the procedure more generally applicable.

1.0 Scope and Objective

This procedure applies to the performance of thermal expansion measurements in the laboratory in support of work for the Yucca Mountain Site Characterization Project.

2.0 Prerequisites

Before performing work under this technical procedure, personnel must be trained by the Principal Investigator (PI) and demonstrate their proficiency in performing the work in this procedure. The PI has the responsibility for generating a record of the personnel proficiency training, as well as the responsibility that work is performed and documented in accordance with this procedure.

The personnel using this procedure are responsible for ensuring that a controlled copy of this procedure is available and used for performing the work in this procedure.

3.0 Description of Activity

This TP will detail the process for measuring the dimensions of rock specimens before and after step increases in temperature. The experiments will be performed on right-circular cylinders of tuff with nominal length to diameter ratios between 1:1 and 2:1.

Under this procedure, the thermal expansion of the rock specimen will be determined from simple measurements of the length dimension of the specimen at different temperatures. The measurements of temperature and length will be taken with calibrated, precision instruments and recorded on the Measurement Data Report (MDR) forms.

4.0 Operations

4.1 Thermal Expansion Experiments on Rock Specimens

Specimens of tuff will be heated to certain temperatures and then the length of the sample measured and recorded. The following section includes the step-by-step procedures for these thermal property experiments.

4.2.1 Experiment Procedures

1. The specimen designated for testing will be removed from storage. A list of all measuring devices with their serial numbers and any other pertinent information will be recorded on the MDR.
2. Visually inspect the rock core. Any major surface irregularities/imperfections should be noted on the MDR, along with a sketch and/or a photograph of the specimen.
3. Measure the length of the sample at one or more location(s) (multiple locations are preferable if the specimen geometry permits) around the circumference of the sample. These measurements shall be measured to an

accuracy of at least 0.05 mm (0.002 in) and then recorded on the MDR form. In addition, the locations of the measurement positions on the sample should be marked so that future lengths will be measured at the same locations for accurate comparisons.

4. Place the sample into an oven.
5. Raise the temperature to the designated level (specified by the PI) at a rate of no more than 2° C per minute.
6. Allow the sample to remain at the designated temperature for at least 24 hours for soaking purposes (i.e., the equilibration of the temperature throughout the sample volume).
7. Remove the sample from the oven and measure the same sample length(s) as in Step 3. The measurement(s) shall be taken within two (2) minutes and then recorded on the MDR.
8. If the highest designated temperature has not been attained, return the sample to the oven and repeat Steps 5 through 7. If the highest temperature has been reached, then follow the PI's instructions for the disposition of the sample (i.e., allowing the sample to cool, putting the sample back in the oven for maintaining temperature until testing, taking the sample for immediate mechanical testing, or other options).
9. Complete the MDR form.

4.3 Safety

There should be no safety hazards other than the normal hazards of the equipment. However, personnel should take extreme caution around the heated rock and other surfaces by wearing appropriate protective covering for hands and other areas of the body that could be exposed to the elevated temperatures. Operations will be in accordance with safety requirements of the facility where the work is being performed and those of the employer of person(s) performing the work.

5.0 Nonconformance, Deviations, and Corrective Actions

Any nonconformances or deviations must be reported to the PI as soon as possible. Deviations, deficiencies and corrective actions must be determined and documented in accordance with AP-15.2Q, *Control of Nonconformances* and AP-16.1Q, *Management of Conditions Adverse to Quality*.

6.0 QA Records

QA records, and any corrections or changes thereto, generated as a result of implementing this procedure will be prepared and submitted as inclusionary QA records (QA:QA) by the PI in

accordance with AP-17.1Q, *Record Source Responsibility for Inclusionary Records*. These records include:

- Proficiency training records (Section 2.0)
- Measurement Data Report (MDR) forms (Section 3.0)
- Calibration records (if applicable)

7.0 References

AP-15.2Q, *Control of Nonconformances*

AP-16.1Q, *Management of Conditions Adverse to Quality*

AP-17.1Q, *Records Source Responsibility for Inclusionary Records*

MEASUREMENT DATA REPORT (MDR)

Test/Sample ID: _____ Requester/PI: _____

Sample Material (rock type, unit, etc): _____

Sketch of Sample:

Notes on Sample: _____

Data Recording Information

Measurement Equipment	Serial/ID Number	Calibration Expiration Date	Comments

Recorded by	Time, Date & Initials	Temperature	Length 1	Length 2	Length 3
		(°C)	()	()	()

Comments:

Form Completed By: Name: _____ Sign/Date: _____